

CORRESPONDENCE

COVID-19 NOTES

To rapidly communicate short reports of innovative responses to Covid-19 around the world along with a range of current thinking on policy and strategy relevant to the pandemic, the Journal has initiated the Covid-19 Notes series.

Rapid Response to an Outbreak in Qingdao, China

After a 2-month period without local transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in China, an outbreak alarm was triggered on October 11, 2020, when three cases of Covid-19 were reported in Qingdao, a coastal city in Shandong Province. Local authorities initiated aggressive contact tracing and quarantine of close contacts of people with confirmed infection. One of the cases initially identified was in a taxi driver who was screened for SARS-CoV-2 as part of routine nucleic acid testing before admission to Qingdao Central Hospital for a transient ischemic attack on October 10. His wife tested positive the next day. She had been working part-time as a nursing assistant at Qingdao Chest Hospital, a facility designated for treating people with imported cases of Covid-19. The third person in this cluster was a man with pulmonary tuberculosis who was treated at the same hospital for 1 month before the outbreak. He was tested at his routine follow-up appointment and was confirmed to be infected with SARS-CoV-2 on October 11. Since the initial epidemiologic evidence suggested that all cases were linked to Qingdao Chest Hospital, the hospital immediately stopped admitting new patients and providing outpatient services.

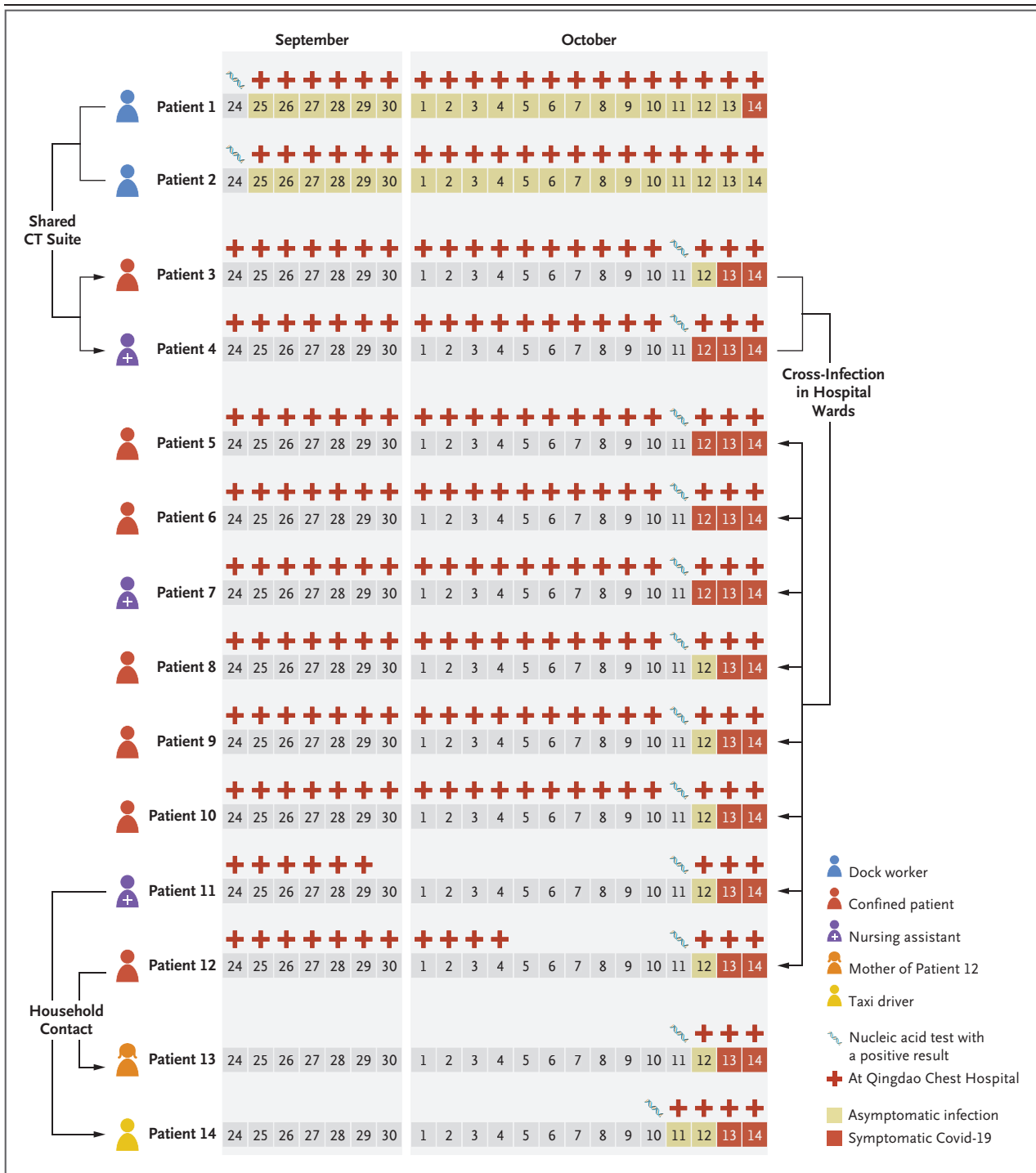
The probable source of this cluster was determined to be two dock workers from the city's port, who were determined on September 24 to have asymptomatic infection. They had no history of travel or contact with anyone confirmed to have Covid-19, but they may have contracted the virus from ship workers or contaminated cargo. These dock workers tested positive during regular biweekly screening for high-risk groups, which was part of the city's Covid-19 surveillance. The infected workers had been sent to Qingdao Chest Hospital for further investigation

and treatment. They did not come into contact with other people who were later found to be infected, but their chest computed tomography (CT) scans were done in the same CT suite that was visited by a hospital patient and a nursing assistant who later tested positive; environmental contamination resulting in cross-infection may therefore have occurred. The timeline of events is summarized in Figure 1.

On the basis of prior experience in Wuhan and Beijing, a government task force was established in response to the outbreak. During the week-long holiday after National Day on October 1, many people had visited Qingdao, and the taxi driver's movements could have led to widespread community transmission. The Qingdao health commission therefore launched a citywide, grid-based mass-screening protocol using reverse-transcriptase–polymerase-chain-reaction (RT-PCR) testing.

Trained medical staff from local hospitals, together with teams dispatched from other cities in Shandong Province, were sent to 4090 testing locations in Qingdao and surrounding suburban areas (see the Supplementary Appendix, available at NEJM.org). Each resident was contacted for testing. Registration information included identity card number, work or residential address, and telephone number. Nasopharyngeal swabs were obtained, and samples were divided into aliquots. To minimize processing time and conserve resources, a pooled testing approach was used, with each pool containing samples from 3 to 10 people (3 for household contacts of infected people, 5 for hospitalized patients or health care workers, and 10 for community members). If a pooled sample tested positive, individual testing was performed on each person in the pool.

By October 16, a total of 10.9 million people



had been tested, and another 9 cases related to the initial cluster were identified using pooled testing, for a total of 12 cases. All testing has now been completed, and no additional cases were found. The outbreak was controlled with-

out a lockdown. Residents were required to wear masks; they were allowed to move freely within the city during the testing process, but they had to have a negative test result before they could use public transportation. People leaving Qingdao

Figure 1 (facing page). Time Course of the Covid-19 Outbreak in Qingdao, China.

The diagram shows the timeline of events in the nosocomial cluster of Covid-19 cases during September and October 2020. Patients 1 and 2 were dock workers at the city's port. During their hospital stay, they underwent chest computed tomography (CT) examination in the CT suite visited by Patient 3, who was hospitalized, and Patient 4, a nursing assistant. The hospitalized patient and the nursing assistant probably later transmitted the virus to six other patients (Patients 5, 6, 8, 9, 10, and 12) and two other health care workers (Patients 7 and 11) who were hospitalized or working in the same ward. Patient 14 (the taxi driver) was infected with SARS-CoV-2 through contact with his wife (Patient 11). Patient 12 had been undergoing treatment for pulmonary tuberculosis at Qingdao Chest Hospital for 1 month and was discharged on October 4, 2020. His mother (Patient 13) was also infected through household contact.

also needed to have a negative PCR test result, and most other provincial governments required visitors from Qingdao to quarantine for 1 week and to have a second negative PCR test result before moving freely.

Testing millions of people in a short period is challenging and requires effective coordination and execution, along with cooperation of residents. In smaller countries, cooperation with neighboring countries is important for assembling the expertise, personnel, and resources necessary to mount a rapid response and minimize the impact of a new outbreak. For countries approaching the end of their first or second pandemic wave before widespread vaccination is available, careful planning at multiple levels of government, especially within the health care sector, will facilitate coordinated management of outbreaks. Regular surveillance and testing of high-risk populations may identify infected people before widespread transmission occurs.

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